

# Next Generation Fiber Coherent Lidar System for Wake Vortex Detection, Phase II

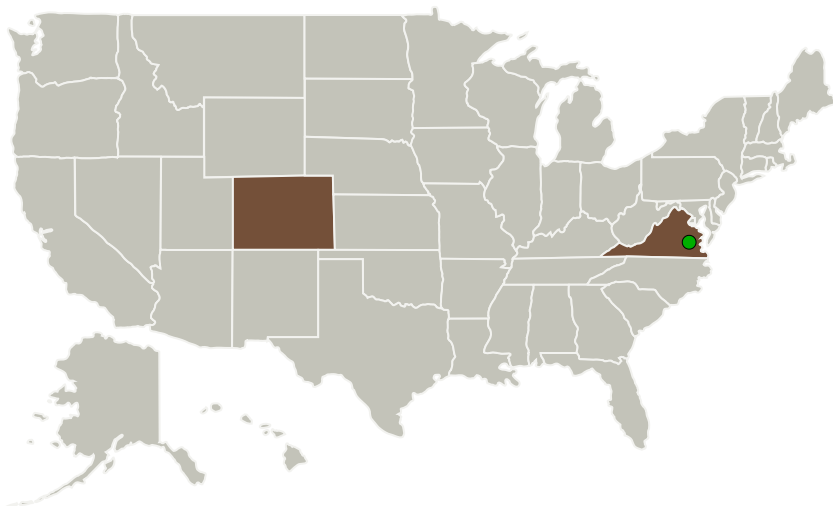
Completed Technology Project (2012 - 2014)



## Project Introduction

LIDAR (LIght Detection And Ranging) systems have proven their value in the remote measurement of spatially resolved atmospheric wind velocities in a number of applications, including the detection of clear-air turbulence, wind shear, aircraft wake vortices, and microbursts. The capacity of coherent LIDAR systems to produce a continuous, real-time 3D scan of wind velocities via detection of the Mie backscatter of atmospheric aerosols in clear-air conditions and at stand-off distances of up to 50 km at relatively low pulse energy gives this technology a clear advantage over other atmospheric monitoring technologies. During the execution of contract NNX11CG87P SIBELLOPTICS assembled the key components of the fiber-based transceiver in a breadboard system and demonstrated performance against proprietary LIDAR modeling. In addition, we were able to demonstrate 12 hour battery-powered operation, a unique, compact BPLO method that uses quad-cells, and were able to take a significant step towards future miniaturization by packaging the fiber sub-assembly on a 1-ft x 1-ft optical bench. In Phase II, it is proposed that, based upon Phase I efforts, a brassboard version of the fiber-LIDAR system be designed, assembled, and tested including data collection, processing, and display capabilities. The system will include custom opto-mechanical designs of mounts and benches, packaged components for reduced SWAP and more robust operation, and higher output energy to increase sensitivity. Software will be developed to demonstrate real-time capability to collect, process, and display data in real-time using a unique interactive user interface.

## Primary U.S. Work Locations and Key Partners



**NASA SBIR/STTR Technologies**

**Next Generation Fiber Coherent Lidar Breadboard System for Wake Vortex Detection with Data Processing and Display**

SIBELLOPTICS, LLC  
Boulder, CO  
Proposal No. 89-2-A3-02-0300

**Identification and Description of Innovation**

SIBELLOPTICS is designing a compact, eye-safe, long-range, variable air fiber wind LIDAR system for atmospheric wind velocity measurement applications, including high-resolution wake vortex measurement. The all-fiber system is more efficient and reliable at a much lower upfront and lifetime cost than any wind LIDAR system currently available.

Estimated TRL at beginning TRL 4  
Estimated TRL at end of contract TRL 5

**Technical Objective**

The Phase II objective is to design and build a breadboard fiber-LIDAR system based on the breadboard design. The breadboard system will include custom mechanical design and packaging, a higher energy amplifier for operation at longer ranges, and data processing and display capability. The integrated system will be extensively field tested, possibly at a local airport (depending on permission).

**Work Plan**

1. Management 420 hours
2. Hardware Development 2,022 hours
3. Software Development 1720 hours
4. Field Testing 900 hours

**NASA and Non-NASA Applications**

NASA: Wake Vortex detection & measurement  
Commercial:

1. Generalized Wind Energy
2. Yacht/Instrumented Harbor Subscriptions
3. Meteorological Applications
  - Pollution tracking
  - Storm and rain gauge tracking

**Team Contacts**

Allen J. Tracy (PI)  
Phone: 303.442.2505 email: atjtracy@msi.com

**NON-PROPRIETARY DATA**

Next Generation Fiber Coherent Lidar System for Wake Vortex Detection

**Table of Contents**

|  |   |
|--|---|
| Project Introduction                         | 1 |
| Primary U.S. Work Locations and Key Partners | 1 |
| Project Transitions                          | 2 |
| Images                                       | 2 |
| Organizational Responsibility                | 2 |
| Project Management                           | 2 |
| Technology Maturity (TRL)                    | 3 |
| Technology Areas                             | 3 |
| Target Destinations                          | 3 |

# Next Generation Fiber Coherent Lidar System for Wake Vortex Detection, Phase II

Completed Technology Project (2012 - 2014)



| Organizations Performing Work   | Role                    | Type        | Location            |
|---------------------------------|-------------------------|-------------|---------------------|
| Sibelloptics                    | Lead Organization       | Industry    | Lafayette, Colorado |
| ● Langley Research Center(LaRC) | Supporting Organization | NASA Center | Hampton, Virginia   |

| Primary U.S. Work Locations |          |
|-----------------------------|----------|
| Colorado                    | Virginia |

## Project Transitions

**April 2012:** Project Start

**March 2014:** Closed out

### Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/138356>)

## Images



## Project Image

Next Generation Fiber Coherent Lidar System for Wake Vortex Detection

(<https://techport.nasa.gov/image/128046>)

## Organizational Responsibility

### Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

### Lead Organization:

Sibelloptics

### Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

## Project Management

### Program Director:

Jason L Kessler

### Program Manager:

Carlos Torrez

### Principal Investigator:

Allen J Tracy

### Co-Investigator:

Allen Tracy

## Next Generation Fiber Coherent Lidar System for Wake Vortex Detection, Phase II

Completed Technology Project (2012 - 2014)



### Technology Maturity (TRL)

Start: **4**  
Current: **5**  
Estimated End: **5**



### Technology Areas

#### Primary:

- TX08 Sensors and Instruments
  - └ TX08.1 Remote Sensing Instruments/Sensors
    - └ TX08.1.5 Lasers

### Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System